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Geotechnical Properties of Fluid Mud

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LONG-TERM GOALS:

1. Determine the physical response of fluid and consolidated mud on water-waves and quantify the changes in the consolidated mud bed that occur during the buildup towards and onset of sediment fluidization.
2. Determine the relationship between in situ yield strength properties or the critical stress required for fluid mud to initiate flow, shear strength and the rheologically determined properties of the mud, specifically the initial yield strength as determined with a rheometer in the laboratory.

OBJECTIVES

The scientific objective is to determine the role of fluid mud behavior in the dissipation of water-wave energy. This will be accomplished by supplying Alex Sheremet with data on the mud, which will be incorporated into Alex's model.

APPROACH

Cruises to the Atchafalaya Basin were made to make in situ bearing strength measurements using the MKII Sting penetrometer through two parallel tracks, one to the east, in the vicinity of the river discharge, and one to the west, closer to the MURI site. Sediment cores were collected for shear strength measurements, grain size, water content and organic matter. These measurements are complete, data is being compiled and analyzed. Additionally, geotechnical measurements of viscosity and yield strength were conducted using a variable shear rate/variable shear rheometer. Bearing strength measurements will be made in situ. Density and shear strength measurements will be made in the lab on cores. Sediment behavior and viscosity will be determined for variably dense mixes of fluid mud. The results from these analyses will provide parameters for the UF modeling efforts and will complement the geochronology work done by UT. The geotechnical data will be used to understand how mud properties change during the time during the spring season when river discharge peaks and then wanes. The data collected will be provided to Alex Sheremet for incorporation into his wave energy dissipation model.

WORK COMPLETED

In situ measurements of bearing strength, laboratory measurements of shear strength, grain size, water content and organic matter, as well as viscosity measurements have been made from five cruises into the Atchafalaya during the spring season. Data has been provided to Alex Sheremet to incorporate

into the wave-damping model. One paper was completed and submitted from work done previously in this area.

RESULTS

Results are still being compiled and significant relationships that can be made for these determinations are not complete.

IMPACT/APPLICATIONS

Water-wave damping models are better constrained by accurately determined rheological properties and strength for ranges of mud density. Mud and simultaneously determined wave data (Allison and Sheremet, 2008) can be used directly in several different numerical models to address wave mud interactions in the presence of fluid mud. The well constrained data on fluid mud will continue to assist efforts will help assess the accuracy of the predictive capabilities that these numerical models possess.

RELATED PROJECTS

1. Wave/Mud Interactions MURI project is established to address the interactions between water-waves and muddy sediments

2. Tidal Flats DRI

PUBLICATIONS

1. Sergio Jaramillo, Alex Sheremet, Mead A. Allison, **Allen H Reed**, and K. ToddHolland, Wave-Mud Interactions Over the Muddy Atchafalaya Subaqueous Clinoform, Louisiana, USA: Wave-Driven Sediment Transport, J. Geophysical Research – Oceans (submitted)